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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Electro-acoustic calling devices.**

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(73) Proprietor: **The General Electric Company, p.l.c.**
1 Stanhope Gate
London W1A 1EH (GB)

(72) Inventor: **Vickers, Keith John**
11 Swinburne Road
Darlington County Durham (GB)
Inventor: **Carr, Allan George**
28 Westwood Avenue Heighington
Darlington County Durham, DL5 65A (GB)

(74) Representative: **Dolwin, John Davison**
Central Patent Department Wembley Office The General Electric Company, p.l.c. Hirst Research Centre East Lane
Wembley Middlesex HA9 7PP (GB)

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Description

The present invention relates to electro-acoustic calling devices and is more particularly although not exclusively concerned with such devices for use in telephone instruments.

Whilst the majority of telephone instruments currently in use particularly in the United Kingdom are equipped with bells having an electromagnetically operable striker for calling purposes some instruments are now being fitted with other tone calling devices.

One such electro-acoustic tone calling device comprises a flat metal disc clamped at its edges and having an electrically responsive (piezo) crystal attached thereto. When an electric current passes through the crystal in one direction the crystal tends to exert pressure on the metal plate in one direction. When current passes through the crystal in the opposed direction the pressure exerted on the metal plate is in the opposed direction.

Thus application of an alternating current to the crystal causes the metal plate to vibrate and such acoustic calling devices may produce a considerable noise. A specific form of such a calling device is disclosed in United Kingdom Patent No. 1434056.

Controlling the volume of the output of such calling devices may involve electrical circuits which are costly to manufacture.

Some alternative methods of controlling the volume of sound emitted from a sound generator are known. In general these methods involve varying in some manner the size of the aperture(s) through which the sound from the acoustic calling device is emitted.

Examples of such control systems include those disclosed in United Kingdom Patent Specification No. 2082018A, French Patent Specification No. 2273335 and United States Patents Nos. 3,826,333 and 1,884,724.

Particular reference is made to United Kingdom Specification No. 2082018 in which two members each having at least one aperture are moved with respect to each other to vary the size of an effective aperture through which sound generated by a tone sounder may pass.

In these previous systems there is no apparent relationship to a user between the change in the volume of sound emitted by the tone caller and the distance through which the volume control means is moved.

It is one object of the present invention to provide an electro-acoustic calling device the volume of whose output may be controlled without alteration of the electric signals supplied thereto and in which there is an apparent linear relationship between the distance through which volume control means is moved and the change in sound intensity of the device.

According to the present invention in an electro-acoustic calling device of the kind comprising an electro-acoustic transducer responsive to electrical signals applied to inputs thereof to provide an audible signal, and a housing which surrounds said transducer said housing having a planar member including at least one aperture through which sound waves may pass substantially unimpeded, said housing has a second planar member which is moveable with respect to the first planar member and which includes at least one aperture, said second planar member being positioned such that movement of the planar members with respect to each other causes a variation in the unimpeded path of sound waves so as to provide variable attenuation of the output of the transducer and said apertures are of a size and positioned such that there is a logarithmic relationship between the attenuation of the output and the position of the planar members with respect to each other so that there is an apparent linear relationship between the distance through which one of the members is moved and the change in sound intensity of the device as heard by a human ear.

Preferably said second planar member is rotatably attached to the first planar member and is positioned such that at least a part of the second planar member extends beyond an edge of the first planar member to facilitate manual rotation thereof.

Said first planar member may be integral with the housing.

The planar members may be disc shaped members of plastics material, one of said members including a single aperture and the other planar member including a plurality of apertures which are substantially smaller than said single aperture.

A spigot and channel arrangement may be provided to limit movement of the planar members within minimum and maximum volume levels of the calling device.

An embodiment of a calling device in accordance with the invention will now be described with reference to the accompanying drawings of which:—

Figure 1 is a plan view of the calling device

Figure 2 is a reverse plan view of the device of Figure 1;

Figure 3 is a cross section on the line III—III of Figure 2;

Figure 4 shows a part of Figure 1 in greater detail;

Figure 5 is another view of the part shown in Figure 4;

Figure 6 shows a cross section on the line VI—VI of Figure 4; and

Figure 7 shows the distribution of apertures of the part of Figure 4.

Referring first to Figures 1, 2 and 3 the calling device comprises a disc shaped aluminium plate 1 to which a ceramic disc 2 is bonded and electrical contact springs 3 and 4. The ceramic disc 2 is of the kind previously referred to. Thus if an electric current passes from the contact spring 3 to the contact spring 4 the disc 2, and consequentially the plate 1, flexes in one direction whilst if an electric current passes from the

contact spring 4 to the contact spring 3 the disc 2 and the plate 1 flex in the opposed direction.

The plate 1 is fitted to a front housing member 5 and is clamped in position by a rear housing member 6. The plastics material from which the housing is made being semi-rigid co-operation of respective moulded interlocking joints 9 and 10 of the housing members 5 and 6 locks the two parts of the housing together.

The front housing member 5 has an aperture 7 centrally located therein. Thus sound waves characterised by variations in air pressure in the cavity 8 would, if the aperture 7 was unobstructed, pass freely to the surrounding atmosphere by way of the aperture 7. In order to reduce the volume of sound passing into the atmosphere by way of the aperture 7 a disc member 11, also of plastics material is provided. The disc member 11 is rotatable about a split spigot 12 moulded integrally with the front housing member 5. The spigot 12 passes through a centrally located circular aperture 13 in the disc member 11 and holds the disc member 11 to the housing member 5 with four overlapping locking sections. The flexibility of the material of the housing member 5 is again used so that the disc member 11 is forced over the spigot 12, the locking sections then springing over the edges of the aperture 13. To facilitate fitting of the disc member 11, the spigot 12 is moulded with chamfered edges.

The disc member 11 is provided with a number of carefully positioned apertures 14 each of which is the same size and very much smaller than the aperture 7. As the disc member 11 is rotated about the spigot 12 varying number of the apertures 14 and parts of them permit free transfer of sound waves from the cavity 8. Thus in one extreme there may be none of the apertures 14 aligned with the aperture 7 whilst at the other extreme all twenty-four of the apertures 14 will be aligned. These two extremes represent the minimum and maximum volume positions of the calling device.

The location of each of the apertures, as will be explained hereinafter is extremely important. Volume of sound as detected by a human ear is not a linear function. In electrical volume controls a logarithmic variable resistance is used. Since the present invention aims to reduce the cost of calling devices provision of an electric volume control would be an undesirable expense. Thus the apertures 14 are positioned such that rotation of the disc member 11 from the minimum to the maximum positions causes a logarithmically increasing exposure of the aperture 7 and vice-versa.

To prevent an additional exposure of the aperture 7 other than by way of the apertures 14 an acoustic seal 15 of, for example, polythene is provided. The seal 15 is a push fit to the housing member 5 and contacts the underside of the disc member 11.

Referring also to Figure 4, 5 and 6 the disc member 11 has a cutaway channel 16 formed in its underside which channel 16 cooperates with a spigot 17 of the front housing member 5 to prevent the disc member 11 being turned beyond the maximum and minimum volume levels.

To facilitate manual rotation of the disc member 11 the edge thereof may be knurled or formed with a knurled edge. A separate volume control operating member is not required when the calling device is suitably located for example in a telephone instrument, with part of the disc member 11 passing through a suitable aperture in the telephone instrument casing (not shown).

To assist implementation of the invention Figure 7 shows a co-ordinate chart giving respective X and Y coordinate location for one particular set of the apertures 14. It will be appreciated that other implementations of the set of apertures 14 may be used provided that the logarithmic exposure relationship is maintained.

It will also be realised that a set of apertures forming minor sound outlets may be included in the front housing member 5 with a large aperture being formed in the disc member 11.

Claims

1. An electro-acoustic calling device of the kind comprising an electro-acoustic transducer responsive to electric signals applied to inputs thereof to provide an audible output signal and having a housing which surrounds said transducer and which has a first planar member (5) including at least one aperture (7) through which sound waves may pass substantially unimpeded and a second planar member (11) which is moveable with respect to the first planar member (5) and which includes at least one aperture (14), and said second member is positioned such that movement of the planar members (5 & 11) with respect to each other causes a variation in the unimpeded path of sound waves so as to provide variable attenuation of the output of the transducer said device being characterised in that said apertures (14 & 7) are of a size and positioned such that there is a logarithmic relationship between the attenuation of the output and the position of the planar members (5 & 11) with respect to each other so that there is an apparent linear relationship between the distance through which one of the members (11) is moved and the change in sound intensity of the device as heard by a human ear.

2. An electro-acoustic calling device as claimed in Claim 2 wherein said second planar member (11) is rotatably attached to said first planar member (5).

3. An electro-acoustic calling device as claimed in Claim 2 in which said second planar member (11) is a disc shaped member.

4. An electro-acoustic calling device as claimed in Claim 2 or Claim 3 wherein at least part of said second planar member (11) extends beyond an edge of said first planar member (5) to facilitate manual rotation thereof.

5. An electro-acoustic calling device as claimed in any preceding claim in which said first planar

member (5) is integral with said housing.

6. An electro-acoustic calling device as claimed in any preceding claim wherein one of the planar members (5) includes a single aperture (7) and the other planar member (11) includes a plurality of apertures (14) which are substantially smaller than said single aperture (7).

7. An electro-acoustic calling device as claimed in Claim 6 in which said planar members (5 and 11) are moveable with respect to each other between a minimum position in which a minority of said plurality of smaller apertures (14) are in alignment with said single aperture (7) and a maximum position in which a majority of said plurality of smaller apertures (14) are in alignment with said single aperture (7).

8. An electro-acoustic calling device as claimed in any preceding claim in which limiting means are provided to limit movement of said planar members between predetermined minimum and maximum positions, said limiting means comprising a channel (16) in one of the planar members (11) and a spigot (17) which runs in said channel (16) and which is attached to the other planar member (5), said channel being obstructed at said predetermined positions.

Revendications

1. Dispositif électroacoustique d'avertissement du type qui comprend un transducteur électroacoustique sensible à des signaux électriques appliqués à ses entrées et destiné à former un signal audible de sortie et ayant un boîtier qui entoure le transducteur et qui a un premier organe plan (5) comprenant au moins une ouverture (7) par laquelle les ondes sonores peuvent passer pratiquement sant obstacle, et un second organe plan (11) qui est mobile par rapport au premier organe plan (5) et qui comprend au moins une ouverture (14), et le second organe est disposé de manière que le déplacement des organes plans (5 et 11) l'un par rapport à l'autre provoque une variation du trajet des ondes sonores sans obstacle afin que le signal de sortie du transducteur subisse une atténuation variable, ledit dispositif étant caractérisé en ce que les ouvertures (14 et 7) ont une dimension et une position telles qu'il existe une relation logarithmique entre l'atténuation du signal de sortie et la position des organes plans (5 et 11) l'un par rapport à l'autre si bien qu'il existe une relation linéaire apparent entre la distance de déplacement de l'un des organes (11) et la variation d'intensité sonore du dispositif telle qu'elle est entendue par une oreille humaine.

2. Dispositif électroacoustique d'avertissement selon la revendication 2, dans lequel le second organe plan (11) est fixé au premier (5) afin qu'il puisse tourner.

3. Dispositif électroacoustique d'avertissement selon la revendication 2, dans lequel le second organe plan (11) est un organe en forme de disque.

4. Dispositif électroacoustique d'avertissement selon l'une des revendications 2 et 3, dans lequel une partie au moins du second organe (11) dépasse d'un bord du premier organe plan (5) afin que sa rotation à la main soit facilitée.

5. Dispositif électroacoustique d'avertissement selon l'une quelconque des revendications précédentes, dans lequel le premier organe plan (5) est solidaire du boîtier.

6. Dispositif électroacoustique d'avertissement selon l'une quelconque des revendications précédentes, dans lequel l'un des organes plans (5) comporte une ouverture unique (7) et l'autre organe plan (11) comporte plusieurs ouvertures (14) qui sont nettement plus petites que l'ouverture unique (7).

7. Dispositif électroacoustique d'avertissement selon la revendication 6, dans lequel les organes plans (5 et 11) sont mobiles l'un par rapport à l'autre entre une position minimale dans laquelle une minorité des ouvertures plus petites (14) est alignée sur l'ouverture unique (7) et une position maximale dans laquelle une majorité des ouvertures plus petites (14) est alignée sur l'ouverture unique (7).

8. Dispositif électroacoustique selon l'une quelconque des revendications précédentes, dans lequel un dispositif de limitation est destiné à limiter le déplacement des organes plans entre des positions minimale et maximale prédéterminées, le dispositif de limitation comprenant une gorge (16) formée dans l'un des organes plans (11) et un ergot (17) destiné à se déplacer dans la gorge (16) et qui est fixé à l'autre organe plan (5), la gorge étant fermée auxdites positions prédéterminées.

Patentansprüche

1. Elektroakustische Rufeinrichtung mit einem elektroakustischen Wandler, der auf elektrische Signale anspricht, die an seine Eingänge angelegt werden, um ein akustisches Ausgangssignal zu erzeugen, und mit einem Gehäuse, das den Wandler umgibt, und ein erstes Planarteil (5) mit zumindest einer Öffnung (7) aufweist, durch die Schallwellen im wesentlichen unbehindert hindurchtreten sowie ein zweites Planarteil (11), das in bezug auf das erste Planarteil (5) beweglich ist, zumindest eine Öffnung (14) enthält und so angeordnet ist, daß die Bewegung der Planarteile (5, 11) zueinander eine Änderung in dem freien Pfad der Schallwellen bewirkt, wodurch eine variable Dämpfung des Ausgangs des Wandlers erhalten wird, dadurch gekennzeichnet, daß die Öffnungen (14, 7) eine Größe und eine Anordnung zueinander derart aufweisen, daß eine logarithmische Beziehung zwischen der Dämpfung des Ausgangs und der Position der Planarteile (5, 11) zueinander in der Weise gegeben ist, daß eine scheinbare Linearbeziehung zwischen der Strecke, um die eines der Planarteile bewegt wird und der Änderung der Klangintensität der Rufeinrichtung für das menschliche Ohr besteht.

2. Elektroakustische Rufeinrichtung nach An-

spruch 1, dadurch gekennzeichnet, daß das zweite Planarteil (11) drehbar an dem ersten Planarteil (5) befestigt ist.

3. Elektroakustische Rufeinrichtung nach Anspruch 2, dadurch gekennzeichnet, daß das zweite Planarteil (11) ein scheibenförmiges Teil ist.

4. Elektroakustische Rufeinrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß sich zumindest ein Abschnitt des zweiten Planarteils (11) über eine Kante des ersten Planarteils (5) hinaus erstreckt, um eine manuelle Drehung des zweiten Planarteils (11) zu ermöglichen.

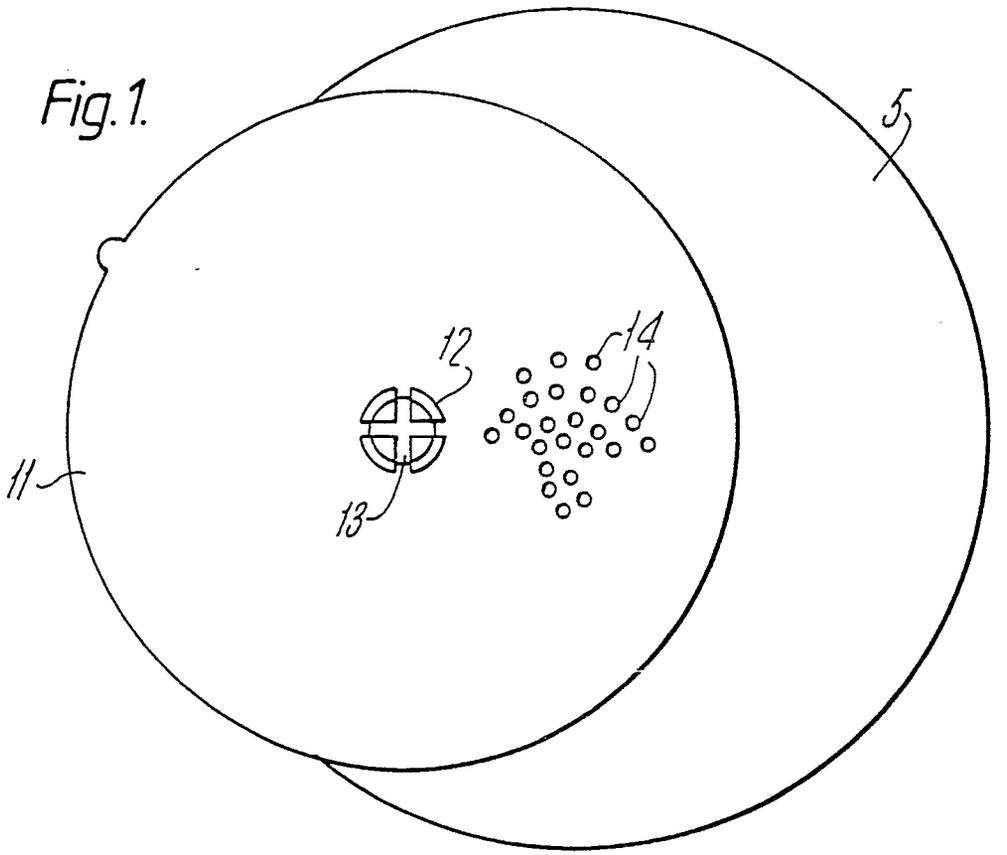
5. Elektroakustische Rufeinrichtung nach jedem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß das erste Planarteil (5) mit dem Gehäuse integriert ist.

6. Elektroakustische Rufeinrichtung nach jedem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß eines der Planarteile (5) eine einzelne Öffnung (7) und das andere Planarteil (11) eine Anzahl von Öffnungen (14) enthält, die erheblich kleiner als die einzelne Öffnung (7) sind.

7. Elektroakustische Rufeinrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Planarteile (5, 11) zueinander zwischen einer Minimum-Stellung, in der eine Minorität der Zahl der kleineren Öffnungen (14) sich mit der einzelnen Öffnung (7) deckt und einer Maximum-Stellung, in der eine Majorität der Zahl der kleineren Öffnungen (14) sich mit der einzelnen Öffnung (7) deckt, bewegbar sind.

8. Elektroakustische Rufeinrichtung nach jedem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß Begrenzungsmittel für die Begrenzung der Bewegung der Planarteile zwischen der vorgegebenen Minimum- und Maximum-Stellung vorhanden sind, daß die Begrenzungsmittel aus einem Kanal (16) in einem der Planarteile (11) und einem Zapfen (17) bestehen, der in den Kanal (16) läuft und an dem anderen Planarteil (5) befestigt ist und daß der Kanal in den vorgegebenen Stellungen blockiert ist.

Fig.1.



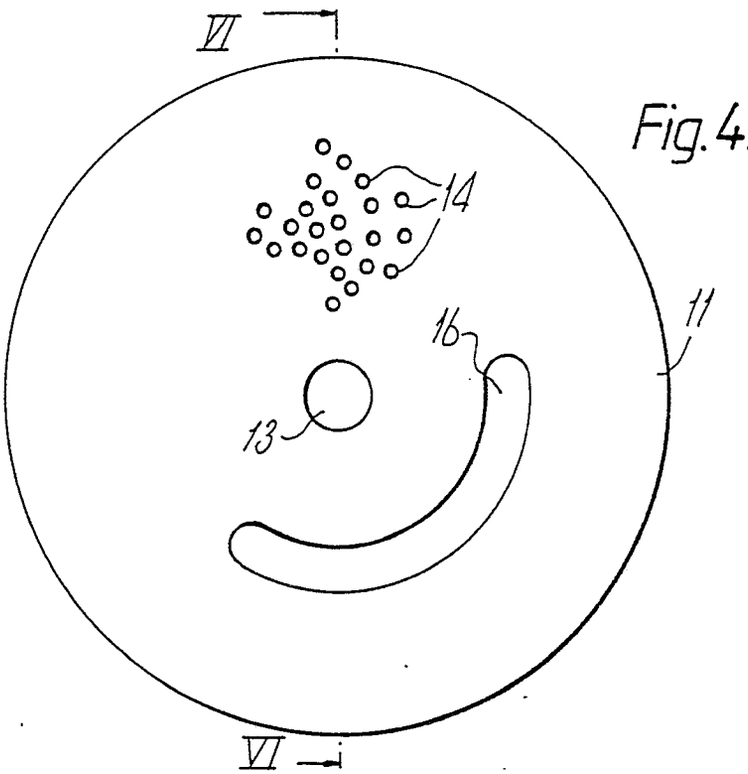


Fig.4.

Fig.2.

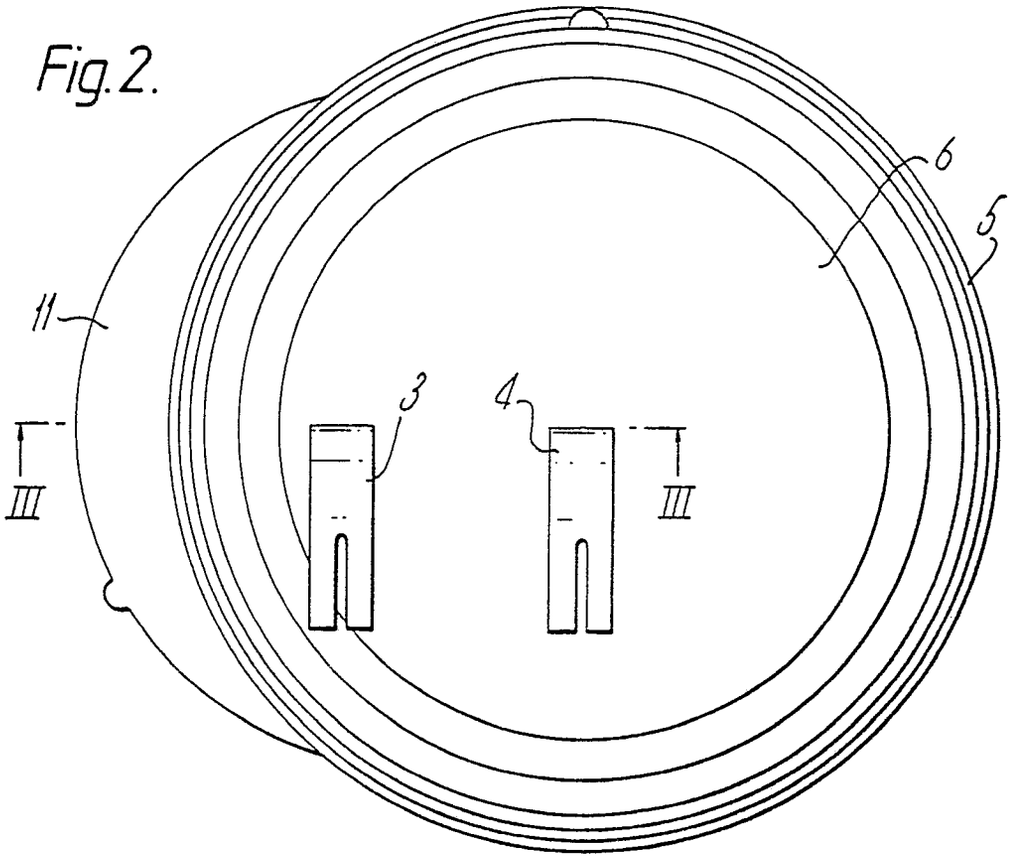


Fig.5.

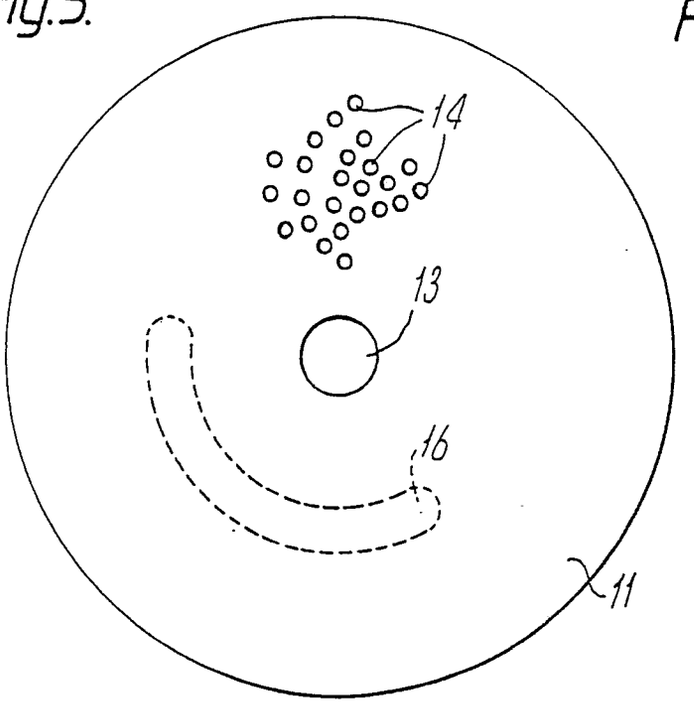
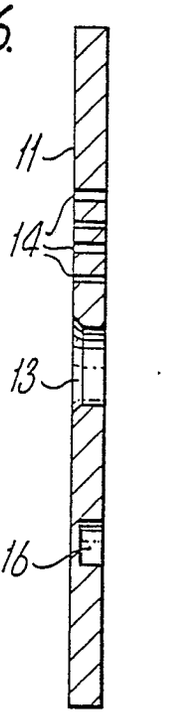


Fig.6.



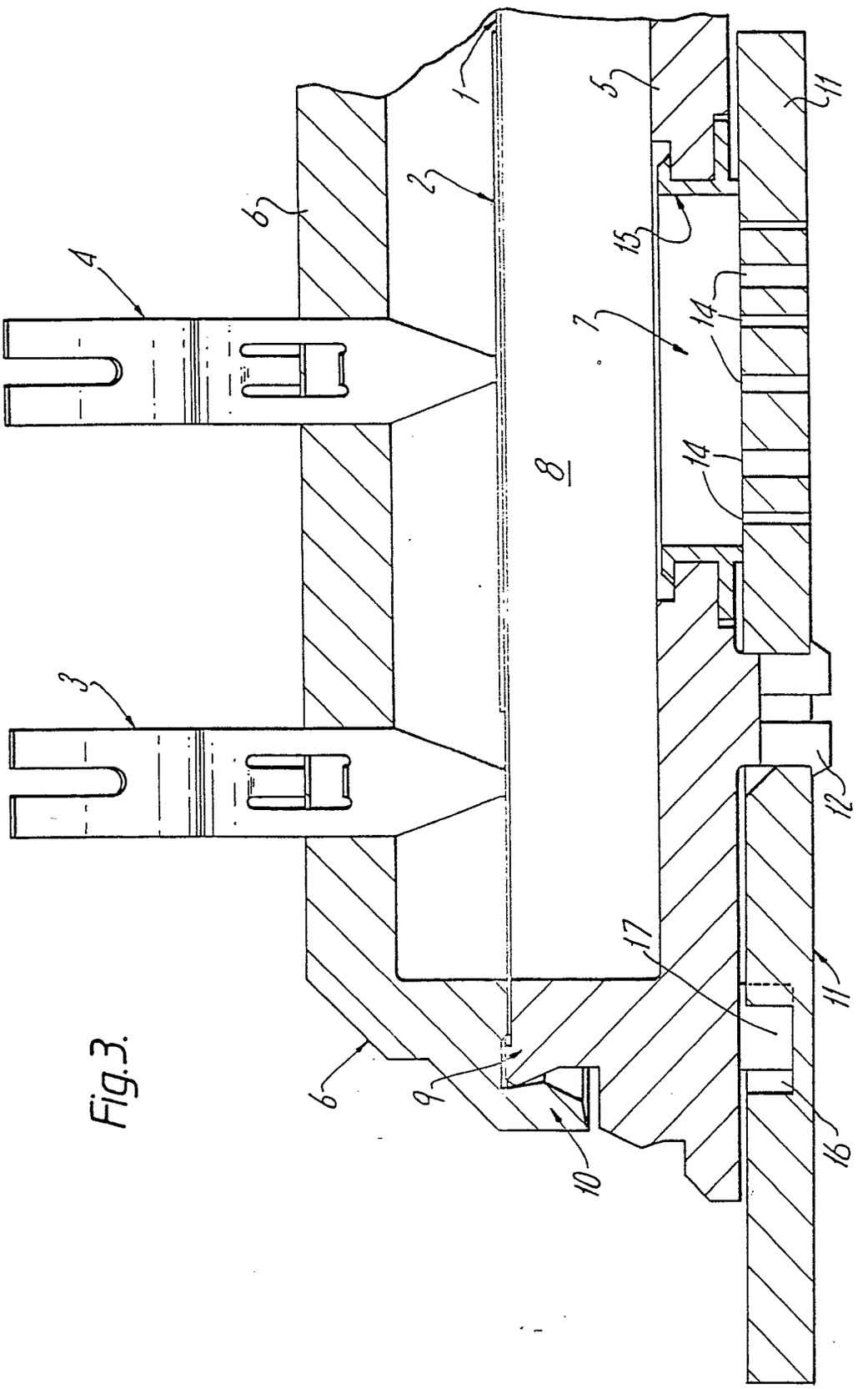
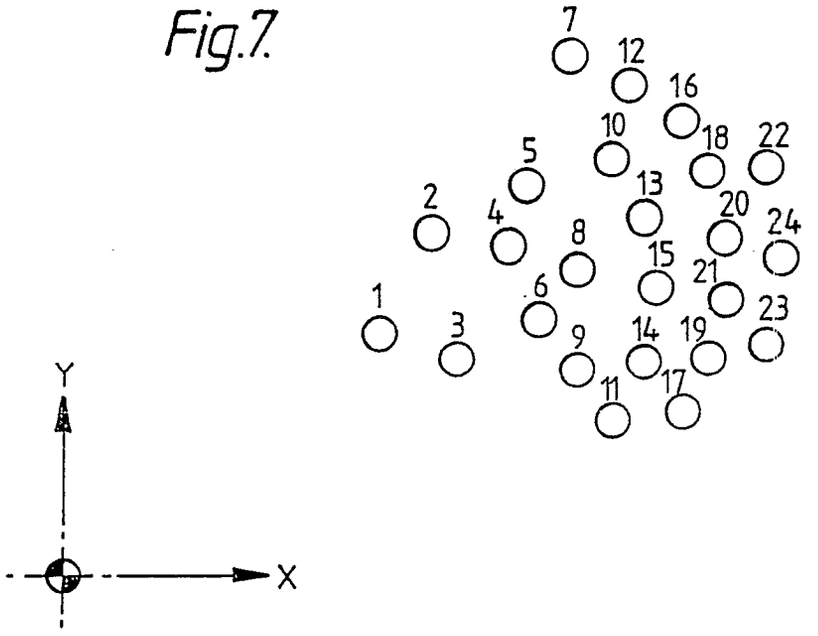


Fig.3.

Fig.7.



HOLE No	X	Y
1	14·98	6·97
2	16·51	9·86
3	17·22	6·35
4	18·66	9·44
5	19·26	11·29
6	19·41	7·40
7	20·36	14·85
8	20·62	8·89
9	20·72	6·01
10	21·62	11·93
11	21·69	4·44
12	21·99	14·07
13	22·52	10·16
14	22·57	6·23
15	22·86	8·20
16	23·31	12·92
17	23·50	4·67
18	24·27	11·41
19	24·40	6·19
20	24·81	9·69
21	24·84	7·92
22	26·11	11·06
23	26·11	6·66
24	26·52	8·85